

WHAT IS CLAIMED IS:

- 1 1. An apparatus for measuring physical properties of a plurality of material
2 samples, the apparatus comprising:
3 a moveable sample holder for containing the plurality of material samples;
4 at least one probe for mechanically perturbing the material samples, the at least one
5 probe having an end;
6 at least one actuator connected to the moveable sample holder for translating the
7 material samples in a direction normal to the end so that the material samples contact the at
8 least one probe; and
9 at least one sensor for monitoring the response of the material samples to mechanical
10 perturbation by the at least one probe.
- 1 2. The apparatus of claim 1, wherein the sensor includes force sensors
2 mechanically linked to the probes.
- 1 3. The apparatus of claim 2, further comprising shafts that mechanically link the
2 force sensors to the probes.
- 1 4. The apparatus of claim 3, wherein each of the shafts includes a rigid core and
2 an insulating outer sheathing.
- 1 5. The apparatus of claim 3, further comprising flexure strips attached to each of
2 the shafts for aligning the probes with the material samples.
- 1 6. The apparatus of claim 3, further comprising an isolation block module for
2 separating the probes and the force sensors.
- 1 7. The apparatus of claim 6, wherein the isolation block module has first and
2 second surfaces and cylindrical apertures for containing the shafts, the cylindrical apertures
3 extending from the first surface to the second surface.
- 1 8. The apparatus of claim 7, further comprising flexure strips for aligning the
2 probes with the material samples, each of the flexure strips attached to the shafts and walls of
3 the cylindrical apertures of the isolation block module.

1 9. The apparatus of claim 1, wherein the actuator is a piezoelectric stack.

1 10. The apparatus of claim 9, wherein the actuator includes a motorized translation
2 slide linked to the piezoelectric stack.

1 11. The apparatus of claim 1, further comprising a control system for regulating
2 environmental conditions of the material samples.

1 12. The apparatus of claim 8, wherein the control system includes an
2 environmental chamber enclosing the material samples.

1 13. The apparatus of claim 1, wherein the force sensors are mounted on at least
2 one flex circuit.

1 14. The apparatus of claim 13, wherein the force sensors are mounted on first and
2 second flex circuits, the first flex circuit disposed above the second flex circuit.

1 15. The apparatus of claim 1, wherein the force sensors are pre-loaded to measure
2 compressive and tensile forces on the probes.

1 16. The apparatus of claim 1, further comprising a data logger for recording
2 responses from the sensor.

1 17. The apparatus of claim 1, wherein each of the probes includes at least one test
2 fixture removeably mounted on a probe base, the probe base distal to the ends of the probes.

1 18. The apparatus of claim 17, wherein the at least one test fixture is magnetically
2 coupled to the probe base.

1 19. The apparatus of claim 17, wherein the at least one test fixture has a blunt end
2 for contacting the material samples.

1 20. The apparatus of claim 17, wherein the at least one test fixture has a sharp end
2 for contacting the material samples.

1 21. The apparatus of claim 17, wherein the test fixture is bonded to at least one of
2 the material samples.

1 22. The apparatus of claim 21, wherein the test fixture is oriented to either extend
2 or compress the material sample during translation of the material samples.

1 23. The apparatus of claim 21, wherein the test fixture is oriented to shear the
2 material sample during translation of the material samples.

1 24. The apparatus of claim 17, wherein the test fixture has a low coefficient of
2 friction with respect to the material samples.

1 25. The apparatus of claim 17, wherein the test fixture includes a loop of a
2 polymeric film.

1 26. The apparatus of claim 17, wherein the test fixture includes an axisymmetric
2 well for shearing one of the material samples.

1 27. The apparatus of claim 26, wherein the axisymmetric well has lateral walls
2 defining a generally cylindrical surface.

1 28. The apparatus of claim 26, further comprising cylindrical rods attached to the
2 moveable sample holder, the rods in substantial axial alignment with probes.

1 29. The apparatus of claim 17, further comprising:
2 first and second reservoirs; and
3 a tube having a generally cylindrical inner bore, the tube providing fluid
4 communication between the first and second reservoirs;
5 wherein the sample holder includes a piston disposed in the first reservoir for forcing
6 one of the material samples initially contained in the first reservoir through the tube and into
7 the second reservoir.

1 30. The apparatus of claim 1, wherein the apparatus is capable of measuring at
2 least one physical property of at least eight samples simultaneously.

1 39. The system of claim 38, wherein the rigid substrate has a low coefficient of
2 friction with respect to the material samples.

1 40. The system of claim 38, wherein the materials are bonded to at least one of the
2 rigid substrate and the end of the at least one probe.

1 41. The system of claim 40, wherein the array of material samples and the probes
2 are oriented either to extend or compress the materials during translation of the array material
3 samples.

1 42. The system of claim 40, wherein the array of material samples and the probes
2 are oriented to shear the materials during translation of the array of material samples.

1 43. The system of claim 35, wherein the array of material samples comprises
2 cylindrical rods coated with materials.

1 44. The system of claim 35, wherein the system is capable of screening at least
2 twelve materials simultaneously.

1 45. The system of claim 35, wherein the system is capable of screening at least
2 forty-eight materials simultaneously.

1 46. The system of claim 35, wherein the system is capable of screening at least
2 ninety-six materials simultaneously.

1 47. The system of claim 35, wherein the system is capable of screening the array
2 of material samples based on measurements of at least two different physical properties.

1 48. The system of claim 47, wherein the test methods used to measure the at least
2 two physical properties are selected from the group consisting of flexure, uniaxial extension,
3 biaxial compression, shear, indentation, stress and strain at failure, toughness, tack, loop tack,
4 viscosity, melt flow indexing, storage modulus, and loss modulus.

1 49. A method of screening a combinatorial library of materials comprising:
2 mechanically perturbing an array of a plurality of materials by contacting at least two
3 of the materials simultaneously with probes; and

